Agroforestry on arable land

Agroforestry on arable land (Netherlands)

Agroforestry in Zevenbergen

DESCRIPTION

Willow and hazelnut trees have been planted in strips on arable land to reduce windspeed, decrease the leaching of nutrients and attract and support natural enemies of crops pests.

This agroforestry technology is being implemented on an arable field of 5.48 hectares in the South-West of the Netherlands. Strips of willow and hazelnut trees have been planted and arable crops are grown in between these strips. The outside of the field is banded with herb-rich grassland to attract natural enemies of the crop pests. In total there are four trees strips (two each of willow and hazelnut), each strip of 5 metres x 240 metres and separated by 42 metres. The land between tree strips is used for annual cropping. The willow trees were planted to produce biomass for bedding in a goat pen, and the hazelnuts were planted for the production of hazelnuts. The willows, especially, will attract many natural enemies to control insect pests of the crops. All trees were bought from a local grower. A planting machine was used to plant the cuttings (3600 pieces) of willow. The hazelnut seedlings (192 pieces) were planted by hand. Weed control between the rows of hazelnut trees will be done by a motorised two-wheel cultivator. Furthermore, a picking machine in front of a small tractor will be used to collect the hazelnuts. The farmer hopes that the trees will develop steadily and the first products can be harvested within three years.

LOCATION

Location: Zevenbergsche Hoek, Noord-Brabant, Netherlands

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 4.69177, 51.66673

Spread of the Technology: evenly spread over an area (approx. < 0.1 km2 (10 ha))

In a permanently protected area?: No

Date of implementation: 2021

Type of introduction
- [x] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [x] through projects/ external interventions

Hazlenut whips

Planting hazlenuts in wind break rows

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Land use mixed within the same land unit: Yes - Agroforestry

Cropland

- Annual cropping: cereals - wheat (spring), root/tuber crops - potatoes, vegetables - root vegetables (carrots, onions, beet, other)
- Tree and shrub cropping: tree nuts (brazil nuts, pistachio, walnuts, almonds, etc.)

Number of growing seasons per year: 1
Is intercropping practiced? No
Is crop rotation practiced? Yes

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [x] prevent land degradation
- [ ] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

soil erosion by wind - Et: loss of topsoil

SLM group

- agroforestry
- windbreak/ shelterbelt
- integrated pest and disease management (incl. organic agriculture)

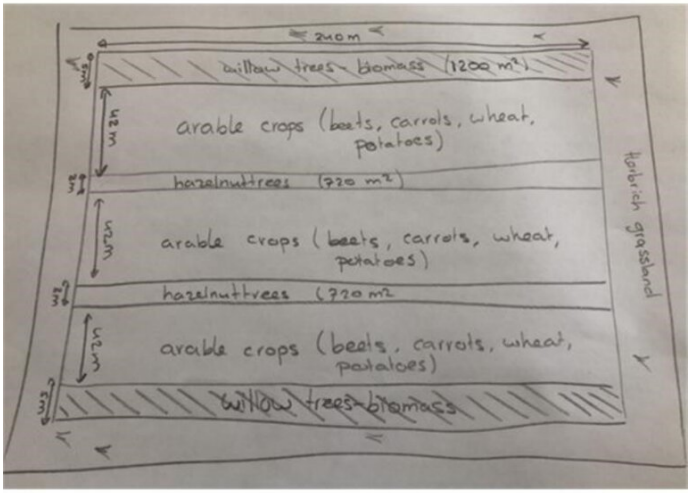
SLM measures

vegetative measures - V1: Tree and shrub cover

TECHNICAL DRAWING

Technical specifications

2 Strips of willow trees.: planting distance 1,5 by 1,5 meters. Cutting cycle 3 years. 3600 cuttings were planted
2 strips of hazelnut trees: Planting distance 5 by 2,5 meters. 195 hazelnut trees were planted.
Distance between tree rows: 42 meters



Author: Tijmen Hoogendijk

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **per 5.48ha field**)
- Currency used for cost calculation: **Euro**
- Exchange rate (to USD): 1 USD = 0.92 Euro
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

Climate impacting requirement of irrigation time will vary. Main future cost is harvesting and the net costs with nut crop yield.

Establishment activities

1. Planting the trees (Timing/ frequency: Winter)
2. Cutting williow for planting (Timing/ frequency: Winter)

Establishment inputs and costs (per per 5.48ha field)

Specify input	Unit	Quantity	Costs per Unit (Euro)	Total costs per input (Euro)	% of costs borne by land users
Labour					
Planting trees by hand by farmer	hours	16.0	50.0	800.0	100.0
Equipment					
Planting machine willow cuttings	each	1.0	300.0	300.0	100.0
Plant material					
Willow cuttings	Cuttings / trees	3600.0	0.2	720.0	100.0
Hazelnut trees	trees	200.0	2.5	500.0	100.0
Total costs for establishment of the Technology				**2'320.0**	
Total costs for establishment of the Technology in USD				*2'521.74*	

Maintenance activities

1. Pruning trees (Timing/ frequency: Anually)
2. Irrigating young trees (as req) (Timing/ frequency: summer)
3. Harvesting nuts (Timing/ frequency: Autumn)
4. Weed control (Timing/ frequency: as required)

Maintenance inputs and costs (per per 5.48ha field)

Specify input	Unit	Quantity	Costs per Unit (Euro)	Total costs per input (Euro)	% of costs borne by land users
Labour					
Farmer time for pruning & harvesting	day	3.0	250.0	750.0	100.0
Farmer time for weed control / irrigation (time varies)	day	4.0	250.0	1000.0	100.0
Equipment					
Harvesting machine (price currently unknown)	hire / purchase	1.0			100.0
Total costs for maintenance of the Technology				**1'750.0**	
Total costs for maintenance of the Technology in USD				*1'902.17*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
n.a.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: both ground and surface water

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [ ] Yes
- [x] No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [x] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

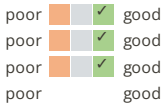
Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [x] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure



markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

Crop production	decreased	increased	loss of land off-set by future nut production
wood production	decreased	increased	Introduction of woody features
production area (new land under cultivation/ use)	decreased	increased	Land given over to windbreak / other production of wood & nuts
land management	hindered	simplified	More variety of skills, equipment and more time required.
expenses on agricultural inputs	increased	decreased	Costs of installation
farm income	decreased	increased	Short-term costs as nut and wood production not quick return
diversity of income sources	decreased	increased	Eventually a diversity of products will support long term sustainability
workload	increased	decreased	Time costly for installation and ongoing maintenence & harvesting.

Socio-cultural impacts

Ecological impacts

soil moisture	decreased	increased	
soil cover	reduced	improved	
soil loss	increased	decreased	Buffer strip action
vegetation cover	decreased	increased	
biomass/ above ground C	decreased	increased	greater above ground with woody features
plant diversity	decreased	increased	
beneficial species (predators, earthworms, pollinators)	decreased	increased	
drought impacts	increased	decreased	
wind velocity	increased	decreased	

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase: not well at all — very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

☑ single cases/ experimental

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

0-10%

- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] No

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Adds a future variety of produce
- Wind break will aid crop protection

Strengths: compiler's or other key resource person's view

- Increases beneficial species
- Improves soil health
- Better long-term business prospects for sustainability

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Short-term financial and time cost Grant funding
- No guarentee of good nut or wood yield Ensure maintenence to highest standard to improve chance of good yield.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Knowledge of markets for new products need to be identified early Gain advice from SLM expert

REFERENCES

Compiler
Alan Radbourne

Editors

Reviewer
William Critchley
Rima Mekdaschi Studer

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Resource persons
Tijmen Hoogendijk - SLM specialist
Piet Hermus - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6879/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- n.a.

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